## 10.0 Permit Requirements

**Part IV. Program Review and Annual Progress Reporting**

**A. Annual Reporting**

1. Annual progress reports, required under 40 CFR 122.42(c), will facilitate the long-term assessment of Baltimore County's NPDES stormwater program. The County shall submit annual reports on or before June 15th of each year that include:

   e. The identification of water quality improvements or degradation

## 10.1 Introduction

The following analysis provides a recalculation of watershed pollutant loads for nitrogen and phosphorus based on guidance from Maryland Department of the Environment on pollutant loading analysis for the Water Resources Element and the Chesapeake Bay Program – Phase 5.2 Watershed Model (Section 10.2). It also presents a summary of the pollutant load reductions (water quality improvements) that have resulted from implementation of the management programs required under this permit. It includes reductions due to implementation of stormwater Best Management Practices (Section 1), reductions due to street sweeping and storm drain cleaning programs (Section 3), and reductions due to capital restoration projects, reforestation, and volunteer efforts (Section 7). Further reductions resulting from illicit connection removals (Section 5) and education activities (Section 4) are discussed under the appropriate section. Actual pollutant load reductions due to illicit connection removals and education activities have not been determined.

With the completion of a number of Total Maximum Daily Load analyses for impaired waters, target load reductions for nutrient, sediment, and bacteria have been determined for a number of watersheds. In addition, additional Water Quality Analyses and proposed modification of the biological listing criteria have resulted in changes to the impairment listings (2008 Integrated Report). Table 10-1 summarizes the reductions required for urban stormwater where they have been determined, on a percentage basis.

**Table 10-1: Status of TMDLs and TMDL Reduction Requirements for Urban Stormwater**

| Watershed | Total Phosphorus | Total Nitrogen | Sediment | Bacteria | Biological | Other (Metals, Toxics) |
|---|---|---|---|---|---|---|
| Deer Creek | NA | NA | NA | NA | NA. | NA |
| Prettyboy | 54% (15% Urban) | NA | NA | 70% | NA | Complete (Mercury) |
| Loch Raven | 50% (15% Urban) | NA | 25% | 23% -98% | Not Comp. | Complete (Mercury) |
| Lower Gunpowder | Not Comp. | Not Comp. | NA | NA | Not Comp. | NA |
| Little Gunpowder | NA | NA | NA | NA | NA | NA |
| Bird River | NA | NA | NA | NA | Insuff. Info | NA |

| | | | | | | |
|---|---|---|---|---|---|---|
| Gunpowder River | NA | NA | NA | NA | Insuff. Info | NA |
| Middle River | NA | NA | NA | NA | Insuff. Info | NA |
| Liberty Res. | Not Comp. | Not Comp. | Not Comp. | 65% | Not Comp. | Complete |
| Patapsco | 15%* | 15%* | 15.1% | 13% - 56% | Not Comp. | Not Comp. |
| Gwynns Falls | 15%* | 15%* | 23.5% - 44.6% | 67.2-93.2% | Not Comp. | NA |
| Jones Falls | 15%* | 15%* | 21.9% | 92.4-95.3% | Not Comp. | Not Comp. |
| Back River | 15% | 15% | NA | 95% | Not Comp. | Complete |
| Baltimore Harbor | 15%* | 15%* | NA | Not Comp. | Not Comp. | Complete |

* Based on TMDL developed for tidal Baltimore Harbor

Additional TMDLs have been completed for chlordane (Back River and Lake Roland), and for mercury in fish tissue (Prettyboy Reservoir, Loch Raven Reservoir, and Liberty Reservoir (not EPA approved)). However, these TMDLs have limited options to address inputs from stormwater discharge due to the nature of the source of pollution (chlordane – historic, mercury – air deposition). A number of listings for impairment have been removed due to Water Quality Assessments that have indicated that the level of particular pollutants is below the existing standards. The most recent Water Quality Assessments have indicated that Jones Falls is not impaired for zinc, and the Patapsco in not impaired for lead or zinc. A summary of the current status of all TMDLs and Water Quality Assessments can be found on the Maryland Department of the Environment web site; http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/Sumittals/index.asp.

The Maryland Tributary Strategies for meeting the Chesapeake Bay Program goals has identified a 24% reduction in nitrogen and a 42% reduction of phosphorus from urban non-point sources. This provides an additional reduction target for nutrients that in some cases exceeds the reductions determined by the TMDL analysis. The differences are due to the target water body being local tidal waters or reservoirs versus the entire Chesapeake Bay. Thus it may be possible to meet local tidal water quality standards, but additional nutrient reductions may be needed to permit the Chesapeake Bay to meet its water quality standards. In the case of the reservoirs the TMDLs are for phosphorus only due to the fact that fresh water is usually phosphorus limited. The models indicate that reductions in nitrogen would result in limited improvement in reservoir water quality.

The Chesapeake Bay Program – Watershed Model Phase 5.3 will be available in 2010. The Chesapeake Bay TDML for nutrients and sediment will be based on this model, as well as, the Airshed Model and the Estuarine Model. The Chesapeake Bay TMDL is expected to be complete in December 2010. Subsequent to the completion of the Bay TMDL, the State of Maryland will allocate load reductions by source sector and local jurisdiction. When those targets become available, they will supersede the current targets in the Tributary Strategies.

## 10.2 Pollutant Load Calculations

The pollutant load calculations were revised from last years' report. The pollutant loading rates for nitrogen and phosphorus were derived from two sources, the technical guidance provided by Maryland Department of the Environment (MDE) entitled *User's Guide for Nutrient Load Analysis Spreadsheet in Support of the Water Resources Element* (MDE 2008) and the Chesapeake Bay Program – Watershed Model Phase 5.2.

The MDE technical guidance provided loading rates for Baltimore County based on three basins, Western Shore (above the fall line), Western Shore (below the fall line), and Susquehanna (above the fall line). These loading rates are based on the Chesapeake Bay Program Watershed Model Phase 4.3 and include the full implementation of the Maryland Tributary Strategy for nutrient reduction, thereby eliminating the need to consider nutrient controls. For consideration of the impacts related to urban development, Baltimore County determined that the urban loading rates without the implementation of urban BMPs would best serve the intent of the MS4 Permit in tracking restorations actually completed and the progress in meeting the various TMDLs that have been developed to date. Thus the final model of nutrient loads was a hybrid between the MDE guidance document for loading rates for all non-urban land uses and the segment specific nutrient loading rates for urban land uses.

The loading rates for the Chesapeake Bay Program (CBP) Watershed Model Phase 5.2 were provided by the Chesapeake Bay Program Office and include four categories of urban land loadings: low density urban pervious, low density urban impervious, high density urban land pervious, and high density urban land impervious. These loading rates are pre BMP reduction loading rates and apply to all of Baltimore County. It is anticipated that refined loading rates will be provided upon development of the Phase 5.3 Watershed Model, with loading rates by watershed segment, and loading rates for sediment. The loading rates applied to each watershed, the MDE segment and the CBP segment used in the pollutant loading analysis are displayed in Table 10-2 for nitrogen and Table 10-3 for phosphorus.

It should be noted that the Phase 5.2 Watershed Model has significantly different urban loadings than the Phase 4.3 Watershed Model. The impervious urban loadings increased while the pervious urban loadings decreased. Urban impervious went from a phosphorus loading of 0.51 pounds/acre to 2.26 pounds/acre. Conversely, the urban pervious phosphorus loading went from 2.06 pounds/ down to 0.43 pounds/acre. The same change occurred with the nitrogen loading with impervious urban increasing from 8.22 pounds/acre to 14.1 pounds/acre, and pervious urban decreasing from 13.63 pounds/acre to 7.24 pounds/acre.

**Table 10-2: Nitrogen Per Acre Pollutant Rate, MDE Segment and CBP Segment**

| | **Deer Creek** | **Liberty<br>Patapsco River** | **Bird River<br>Gunpowder River<br>Middle River<br>Back River<br>Baltimore Harbor** |
|---|---|---|---|
| MDE Seg | Sus | AFL | BFL |
| Low Density Impervious Urban | 14.10 | 14.10 | 14.10 |
| Low Density Pervious Urban | 7.24 | 7.24 | 7.24 |
| High Density Impervious Urban | 14.10 | 14.10 | 14.10 |
| High Density Pervious Urban | 7.25 | 7.25 | 7.25 |
| Crop | 12.23 | 16.55 | 13.54 |
| Pasture | 8.42 | 7.35 | 5.64 |
| Livestock | 15.62 | 24.87 | 19.68 |
| Forest | 2.36 | 1.41 | 1.29 |
| Water | 10.61 | 10.05 | 10 |
| Bare soil | 8.42 | 7.35 | 5.64 |

**Table 10-3: Phosphorus Per Acre Pollutant Rate, MDE Segment and CBP Segment**

| | **Deer Creek** | **Prettyboy<br>Loch Raven<br>Lower Gunpowder<br>Little Gunpowder Falls<br>Gwynns Falls<br>Jones Falls<br>Liberty<br>Patapsco River** | **Bird River<br>Gunpowder River<br>Middle River<br>Back River<br>Baltimore Harbor** |
|---|---|---|---|
| MDE Seg | Sus | AFL | BFL |
| Low Density Impervious Urban | 2.26 | 2.26 | 2.26 |
| Low Density Pervious Urban | 0.427 | 0.427 | 0.427 |
| High Density Impervious Urban | 2.26 | 2.26 | 2.26 |
| High Density Pervious Urban | 0.431 | 0.431 | 0.431 |
| Crop | 0.85 | 0.72 | 0.69 |
| Pasture | 0.44 | 0.73 | 0.66 |
| Livestock | 1.60 | 1.18 | 0.99 |
| Forest | 0.03 | 0.02 | 0.02 |
| Water | 0.57 | 0.57 | 0.57 |
| Bare soil | 0.44 | 0.73 | 0.66 |

In order to determine the acres of impervious cover associated with urban land use, the MDP 2002 (modified to make it current with the 2005 planimetric layer) land use GIS layer was overlain with the planimetric buildings and roadways developed from the 2005 aerials for each watershed. The resulting distribution of land use by watershed is displayed in Table 10-4.

**Table 10-4: 2005 Land Use (Acres)***

| **Watershed** | **Urban** | | **Agricultural Load** | | **Forest** | **Total Acres** |
|---|---|---|---|---|---|---|
| | **Impervious** | **Pervious** | **Crop** | **Pasture** | | |
| Deer Creek | 94 | 423 | 3,148 | 981 | 2,520 | 7,173 |
| Prettyboy | 247 | 1,537 | 8,109 | 1,839 | 12,309 | 25,548 |
| Loch Raven | 5,352 | 22,115 | 39,935 | 11,082 | 58,815 | 139,573 |
| Lower Gunpowder Falls | 2,110 | 7,280 | 5,792 | 3,193 | 10,891 | 29,468 |
| Little Gunpowder Falls | 538 | 2,442 | 4,310 | 3,087 | 6,847 | 17,275 |
| Bird River | 2,499 | 5,926 | 1,944 | 53 | 5,726 | 16,408 |
| Gunpowder River | 348 | 1,570 | 267 | 0 | 3,674 | 5,859 |
| Middle River | 1,364 | 2,952 | 274 | 15 | 1,861 | 6,465 |
| **UW Shore Totals** | **12,552** | **44,245** | **63,779** | **20,250** | **102,643** | **247,769** |
| **Patapsco/Back River** | | | | | | |
| Liberty | 531 | 2,286 | 3,868 | 728 | 8,854 | 17,503 |
| Patapsco River | 4,218 | 13,842 | 2,391 | 1,508 | 11,255 | 33,580 |
| Gwynns Falls | 6,704 | 15,257 | 620 | 353 | 5,666 | 28,654 |
| Jones Falls | 3,907 | 11,033 | 2,138 | 590 | 8,185 | 25,933 |
| Back River | 5,649 | 11,458 | 440 | 7 | 5,487 | 23,113 |
| Baltimore Harbor | 3,050 | 6,328 | 343 | 0 | 1,592 | 11,387 |
| **Patapsco/Back River** | **24,059** | **60,204** | **9,800** | **3,186** | **41,039** | **140,170** |
| ***County Total*** | ***36,612*** | ***104,448*** | ***73,578*** | ***23,435*** | ***143,684*** | ***387,939*** |

* Total Acres will be greater than the sum of the acreage in the table due to leaving out small acreage land uses.

The estimated pollutant loads by watershed are presented in Table 10-5 for nitrogen and Table 10-6 for phosphorus. Each watershed load is broken down into the urban load, the agricultural load, and the forest load with the percentages of each. Note that the nitrogen load calculations include an estimate of the septic load for each watershed.

**Table 10-5: Watershed Nitrogen Loads – Pounds and Percentage***

| Watershed | Urban Load | | Septic Load | | Agricultural Load | | Forest Load | | Total Load |
|---|---|---|---|---|---|---|---|---|---|
| | Pounds | % | Pounds | % | Pounds | % | | | |
| Deer Creek | 4,383 | 7.0 | 5,027 | 8.0 | 46,764 | 74.4 | 5,948 | 9.5 | 62,868 |
| Prettyboy | 14,617 | 7.0 | 15,106 | 7.2 | 147,713 | 70.4 | 17,356 | 8.3 | 209,923 |
| Loch Raven | 235,705 | 18.9 | 165,678 | 13.3 | 743,460 | 59.5 | 82,929 | 6.6 | 1,250,125 |
| Lower Gunpowder Falls | 82,508 | 31.7 | 36,988 | 14.2 | 123,950 | 47.6 | 15,357 | 5.9 | 260,469 |
| Little Gunpowder Falls | 25,279 | 15.9 | 28,233 | 17.8 | 95,007 | 59.9 | 9,654 | 6.1 | 158,636 |
| Bird River | 78,190 | 64.2 | 8,035 | 6.6 | 26,621 | 21.9 | 7,387 | 6.1 | 121,725 |
| Gunpowder River | 16,287 | 59.7 | 2,655 | 9.7 | 3,613 | 13.2 | 4,740 | 17.4 | 27,294 |
| Middle River | 40,633 | 82.5 | 2,419 | 4.9 | 3,788 | 7.7 | 2,401 | 4.9 | 49,240 |
| **UW Shore Totals** | **497,601** | **23.2** | **264,819** | **12.4** | **1,190,916** | **55.6** | **145,772** | **6.8** | **2,140,281** |
| **Patapsco/Back River** | | | | | | | | | |
| Liberty | 24,055 | 17.4 | 19,888 | 14.4 | 69,369 | 50.2 | 12,484 | 9.0 | 138,220 |
| Patapsco River | 159,804 | 60.2 | 36,386 | 13.7 | 50,648 | 19.1 | 15,870 | 6.0 | 265,618 |
| Gwynns Falls | 205,124 | 81.5 | 25,297 | 10.1 | 12,854 | 5.1 | 7,990 | 3.2 | 251,669 |
| Jones Falls | 135,033 | 59.5 | 40,025 | 17.6 | 39,726 | 17.5 | 11,541 | 5.1 | 227,040 |
| Back River | 162,705 | 90.5 | 3,513 | 2.0 | 5,993 | 3.3 | 7,079 | 3.9 | 179,746 |
| Baltimore Harbor | 88,882 | 91.6 | 765 | 0.8 | 4,650 | 4.8 | 2,053 | 2.1 | 97,078 |
| **Patapsco/Back River** | **775,604** | **66.9** | **125,873** | **10.9** | **183,240** | **15.8** | **57,014** | **4.9** | **1,159,372** |
| ***County Load*** | ***1,273,205*** | ***38.6*** | ***390,693*** | ***11.8*** | ***1,374,156*** | ***41.6*** | ***202,788*** | ***6.1*** | ***3,299,653*** |

* Percentages may be less than 100% - direct loading to the water surface and loading from bare ground are not included.

**Table 10-6: Watershed Phosphorus Loads – Pounds and Percentage***

| Watershed | Urban Load | | Agricultural Load | | Forest Load | | Total Load |
|---|---|---|---|---|---|---|---|
| | Pounds | % | Pounds | % | Pounds | % | |
| Deer Creek | 393 | 11.0 | 3,108 | 86.8 | 76 | 2.1 | 3,580 |
| Prettyboy | 1,217 | 12.8 | 7,181 | 75.6 | 246 | 2.6 | 9,504 |
| Loch Raven | 21,588 | 35.4 | 36,871 | 60.5 | 1,176 | 1.9 | 60,961 |
| Lower Gunpowder Falls | 7,896 | 53.1 | 6,620 | 44.5 | 218 | 1.5 | 14,870 |
| Little Gunpowder Falls | 2,262 | 29.0 | 5,382 | 68.9 | 137 | 1.8 | 7,813 |
| Bird River | 8,199 | 83.1 | 1,376 | 14.0 | 115 | 1.2 | 9,861 |
| Gunpowder River | 1,463 | 85.1 | 184 | 10.7 | 74 | 4.3 | 1,720 |
| Middle River | 4,355 | 94.9 | 199 | 4.3 | 37 | 0.8 | 4,591 |
| **Upper Western Shore** | **47,372** | **42.0** | **60,290** | **53.4** | **2,078** | **1.8** | **112,898** |
| **Patapsco/Back River** | | | | | | | |
| Liberty | 2,183 | 34.2 | 3,316 | 52.0 | 177 | 2.8 | 6,381 |
| Patapsco River | 15,489 | 82.4 | 2,822 | 15.0 | 225 | 1.2 | 18,791 |
| Gwynns Falls | 21,721 | 96.2 | 704 | 3.1 | 113 | 0.5 | 22,578 |
| Jones Falls | 13,568 | 86.1 | 1,970 | 12.5 | 164 | 1.0 | 15,763 |
| Back River | 17,699 | 97.4 | 308 | 1.7 | 110 | 0.6 | 18,163 |
| Baltimore Harbor | 9,620 | 96.9 | 237 | 2.4 | 32 | 0.3 | 9,931 |
| **Patapsco/Back River** | **80,281** | **87.6** | **9,358** | **10.2** | **821** | **0.9** | **91,597** |
| ***County Load*** | ***127,653*** | ***62.4*** | ***70,278*** | ***34.4*** | ***2,899*** | ***1.4*** | ***204,495*** |

* Percentages may be less than 100% - direct loading to the water surface and loading from bare ground are not included.

The same type of analysis was used to determine the loading rates to stormwater management facilities (Section 1) and for stormwater management retrofits and conversions (Section 7).

## 10.3 New Nutrient Reduction and Impervious Cover Addressed Tracking Added

Starting with the 2009 Annual Report, the nutrient reductions attributable to the Baltimore County Community Reforestation Program, the Growing Home Campaign, and the efforts of Watershed Associations are included. See Section 7 for a description of how the reductions were calculated. We will continue to seek methods for tracking other

efforts to include in future reports. These other efforts include the Treemendous Program, the Growing Home Campaign, and the number of septic connections to the sanitary sewer. Assessing the effects of education on nutrient reduction is anticipated to take longer and would best be done through cooperation of other MS4 permittees and MDE.

The impervious cover addressed by the Storm Drain Cleaning Program and the Street Sweeping Program was calculated for the first time in the 2009 Annual Report. The methods are detailed in Section 3.

## 10.4 Summary of Pollutant Reduction Programs

Seven components of the County's overall effort to reduce pollutant loads are summarized in Tables 10-7 and 10-8, which address the Upper Western Shore and the Patapsco/Back River drainages, respectively. The components are the Stormwater Management Program (Section 1), the Storm Drain Cleaning Program (Section 3), the Street Sweeping Program (Section 3), the Capital Improvement Program (Section 7), the Community Reforestation Program (Section 7), Growing Home Campaign, and Watershed Association restoration actions (Section 7).

To account for impervious cover addressed by certain types of restoration activities where the drainage area is typically not applicable, a standard formula was used to calculate equivalent impervious acres. The Chesapeake Bay Program – Watershed Model Phase 5.2 has an urban impervious loading of 2.26 pounds per acre of phosphorus. To determine the equivalent impervious acres, the pounds of phosphorus for the practice was divided by 2.26. This formula was applied for the following restoration practices:

- Street sweeping (Section 3)
- Storm drain cleaning (Section 3)
- Reforestation and tree planting (Section 7)
- Shoreline erosion control projects (Section 7).

The results are displayed in the appropriate section and in the summary Tables 10-7 and 10-8 below.

The acreage of impervious surface that are served by stormwater management facilities is not counted toward meeting the impervious surface requirements of the Permit (restore 20% of the impervious surface controlled by Baltimore County). Instead, the impervious surface controlled by State-of-the-Art stormwater management or that which has little or no potential for conversion is subtracted from the Baltimore County controlled impervious surfaces to derive the overall impervious surface acreage that will ultimately be required to be addressed by the current and future NPDES Permits. That number will change annually as more advanced storm water facilities are installed as a result of new development and new redevelopment.

The urban loads for each watershed are presented in each table, along with the progress to date in reducing phosphorus and nitrogen, and in addressing impervious cover. This is a

change from previous reports where TSS reductions were reported. We currently have not developed a satisfactory TSS loading rate analysis. This will be done in the future.

If a TMDL has been developed, the pollutant load reduction expressed as a percentage is shown. In the nutrient TMDLs developed to date, the expectation for the urban non-point source load reduction is 15%. In the case of Prettyboy and Loch Raven Reservoirs, this is less than the over all load reduction needed to meet water quality standards in the receiving waters. The Maryland Tributary Strategies urban pollutant load reduction for nitrogen and phosphorus are 24% and 42%, respectively. However, with the results from the development of the Chesapeake Bay Program – Phase 5.3 Watershed Model available in December 2010, it is expected that the urban reductions will be assigned by tidal segment and will therefore change for the next annual report.

**Table 10-7: Pollutant Removal (Pounds) by Upper Western Shore Watersheds Attributed to BMP's**

| **Upper Western Shore** | | | |
|---|---|---|---|
| **Deer Creek** | | | |
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 0 | 0 |
| Inlet Cleaning | 0 | 0 | 0 |
| Street Sweeping | 0 | 0 | 0 |
| Restoration Projects | 0 | 0 | 0 |
| Reforestation Projects | 0 | 0 | 0 |
| Watershed Association Projects | 0 | 0 | 0 |
| **Totals** | 0 | 0 | 0 |
| **Urban Watershed Imp./Load** | **203** | **393** | **4,383** |
| **% Urban Load Removed** | **0.0** | **0.0** | **0.0** |
| **Prettyboy Reservoir** | | | |
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 18.7 | 182 |
| Inlet Cleaning | 0 | 0 | 0 |
| Street Sweeping | 0 | 0 | 0 |
| Restoration Projects | 0 | 0 | 0 |
| Reforestation Projects | 0 | 0 | 0 |
| Watershed Association Projects | 0 | 0 | 0 |
| **Totals** | 0 | 18.7 | 182 |
| **Urban Watershed Imp./Load** | **535** | **1,217** | **14,617** |
| **TMDL % Reduction/Imp.** | | 54% (15% Urban) | NA |
| **% Urban Load Removed** | 0.0% | 1.5% | 1.2% |
| **Loch Raven Reservoir** | | | |
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 1,151.5 | 8,480 |
| Inlet Cleaning | 4.9 | 11.1 | 29 |
| Street Sweeping | 85.9 | 194.1 | 501 |
| Restoration Projects | 471.0 | 380.0 | 5,633 |
| Reforestation Projects | 19.9 | 45.0 | 565 |
| Watershed Association Projects | 0 | 46.4 | 326 |
| **Totals** | 581.7 | 1,828.1 | 15,534 |
| **Urban Watershed Imp./Load** | **6,170** | **21,588** | **235,705** |
| **TMDL % Reduction** | | 50% (15% Urban) | NA |
| **% Urban Load Removed** | 9.4% | 8.5% | 6.6% |

**Table 10-7: Pollutant Removal (Pounds) by Upper Western Shore Watersheds Attributed to BMP's (continued)**

| Lower Gunpowder River | | | |
|---|---|---|---|
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 430.6 | 3,155 |
| Inlet Cleaning | 3.2 | 7.2 | 19 |
| Street Sweeping | 47.8 | 108.0 | 279 |
| Restoration Projects | 434.1 | 283.5 | 5,349 |
| Reforestation Projects | 0.4 | 0.8 | 10 |
| Watershed Association Projects | 0 | 0 | 0 |
| **Totals** | 485.5 | 830.1 | 8,812 |
| **Urban Watershed Imp./Load** | **2,059** | **7,896** | **82,508** |
| **% Urban Load Removed** | 23.6% | 10.5% | 10.7% |
| **Little Gunpowder River** | | | |
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 92.3 | 1,021 |
| Inlet Cleaning | 0.7 | 1.7 | 4 |
| Street Sweeping | 10.5 | 23.6 | 61 |
| Restoration Projects | 0 | 0 | 0 |
| Reforestation Projects | 0 | 0 | 0 |
| Watershed Association Projects | 0 | 0 | 0 |
| **Totals** | 11.2 | 117.6 | 1,086 |
| **Urban Watershed Imp./Load** | **608** | **2,262** | **25,279** |
| **% Urban Load Removed** | 1.8% | 5.2% | 4.3% |
| **Bird River** | | | |
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 900.8 | 5,337 |
| Inlet Cleaning | 2.9 | 6.5 | 17 |
| Street Sweeping | 44.1 | 99.6 | 257 |
| Restoration Projects | 557.1 | 564.6 | 7,482 |
| Reforestation Projects | 0 | 3.5 | 43 |
| Watershed Association Projects | 0 | 0 | 0 |
| **Totals** | 604.1 | 1,575.0 | 13,136 |
| **Urban Watershed Imp./Load** | **2,080** | **8,199** | **78,190** |
| **% Urban Load Removed** | 29.0% | 19.2% | 16.8% |
| **Gunpowder River** | | | |
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 70.7 | 300 |
| Inlet Cleaning | 0.5 | 1.2 | 3 |
| Street Sweeping | 4.5 | 10.1 | 26 |
| Restoration Projects | 25.6 | 41.9 | 139 |
| Reforestation Projects | 1.5 | 74.9 | 488 |
| Watershed Association Projects | 0 | 0 | 0 |
| **Totals** | 32.1 | 198.8 | 956 |
| **Urban Watershed Imp./Load** | **397** | **1,463** | **16,287** |
| **% Urban Load Removed** | 8.1% | 13.6% | 5.9% |

**Table 10-7: Pollutant Removal (Pounds) by Upper Western Shore Watersheds Attributed to BMP's (continued)**

| Middle River | | | |
|---|---|---|---|
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 182.5 | 875 |
| Inlet Cleaning | 3.4 | 7.6 | 20 |
| Street Sweeping | 16.4 | 37.1 | 96 |
| Restoration Projects | 674.7 | 1,501.7 | 3,097 |
| Reforestation Projects | 5.6 | 12.6 | 146 |
| Watershed Association Projects | 0 | 0 | 0 |
| **Totals** | 700.1 | 1,741.5 | 4,234 |
| **Urban Watershed Imp./Load** | **1,146** | **4,355** | **40,633** |
| **% Urban Load Removed** | 61.1% | 40.0% | 10.4% |

**Table 10-8: Pollutant Removal (Pounds) by Patapsco/Back River Watersheds Attributed to BMP's**

| Patapsco / Back River | | | |
|---|---|---|---|
| **Liberty Reservoir** | | | |
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 53.9 | 457 |
| Inlet Cleaning | 0.0 | 0.0 | 0 |
| Street Sweeping | 4.5 | 10.1 | 26 |
| Restoration Projects | 0 | 0 | 0 |
| Reforestation Projects | 0.3 | 0.6 | 7.7 |
| Watershed Association Projects | 0 | 0 | 0 |
| **Totals** | 4.8 | 64.6 | 490.7 |
| **Urban Watershed Imp./Load** | **572** | **2,183** | **24,055** |
| **% Urban Load Removed** | 0.8% | 3.0% | 2.0% |
| **Patapsco River** | | | |
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 760.4 | 5,157 |
| Inlet Cleaning | 10.6 | 23.9 | 62 |
| Street Sweeping | 103.1 | 232.9 | 601 |
| Restoration Projects | 202.7 | 87.2 | 844 |
| Reforestation Projects | 3.8 | 18.8 | 250 |
| Watershed Association Projects | 0 | 8.6 | 59 |
| **Totals** | 320.2 | 1,131.8 | 6,973 |
| **Urban Watershed Imp./Load** | **3,552** | **15,489** | **159,804** |
| **TMDL % Reduction** | | 15% | 15% |
| **% Urban Load Removed** | 9.0% | 7.3% | 4.4% |
| **Gwynns Falls** | | | |
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 1,688.0 | 10,879 |
| Inlet Cleaning | 29.6 | 66.8 | 172 |
| Street Sweeping | 194.2 | 438.9 | 1,132 |
| Restoration Projects | 94.1 | 48.0 | 646 |
| Reforestation Projects | 0.4 | 0.9 | 12 |
| Watershed Association Projects | 0 | 0 | 0 |
| **Totals** | 318.3 | 2,242.6 | 12,841 |
| **Urban Watershed Imp./Load** | **4,919** | **21,721** | **205,124** |
| **TMDL % Reduction** | | 15% | 15% |
| **% Urban Load Removed** | 6.5% | 10.3% | 6.3% |

**Table 10-8: Pollutant Removal (Pounds) by Patapsco/Back River Watersheds Attributed to BMP's (continued)**

| Jones Falls | | | |
|---|---|---|---|
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 644.1 | 4,281 |
| Inlet Cleaning | 5.7 | 12.8 | 33 |
| Street Sweeping | 41.1 | 92.8 | 240 |
| Restoration Projects | 342.3 | 202.0 | 3,466 |
| Reforestation Projects | 3.4 | 7.7 | 97 |
| Watershed Association Projects | 0 | 26.7 | 183 |
| **Totals** | 392.5 | 986.1 | 8,300 |
| **Urban Watershed Imp./Load** | **3,154** | **13,568** | **135,033** |
| **TMDL % Reduction** | | 15% | 15% |
| **% Urban Load Removed** | 12.4% | 7.3% | 6.1% |
| **Back River** | | | |
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 710.6 | 3,773 |
| Inlet Cleaning | 11.8 | 26.7 | 69 |
| Street Sweeping | 138.2 | 312.3 | 805 |
| Restoration Projects | 1,511.3 | 2,534.7 | 6,649 |
| Reforestation Projects | 2.6 | 5.8 | 72 |
| Watershed Association Projects | 0 | 2.2 | 15 |
| **Totals** | 1,663.9 | 3,592.3 | 11,383 |
| **Urban Watershed Imp./Load** | **4,931** | **17,699** | **162,705** |
| **TMDL % Reduction** | | 15% | 15% |
| **% Urban Load Removed** | 33.7% | 20.3% | 7.0% |
| **Baltimore Harbor** | | | |
| | **Impervious Cover (ac.)** | **TP** | **TN** |
| Stormwater Management | ** | 84.0 | 406 |
| Inlet Cleaning | 17.2 | 38.9 | 100 |
| Street Sweeping | 56.8 | 128.3 | 331 |
| Restoration Projects | 660.0 | 1,162.5 | 2,555 |
| Reforestation Projects | 0.8 | 1.9 | 23 |
| Watershed Association Projects | 0 | 0 | 0 |
| **Totals** | 734.8 | 1,415.6 | 3,415 |
| **Urban Watershed Imp./Load** | **2,818** | **9,620** | **88,882** |
| **TMDL % Reduction** | | 15% | 15% |
| **% Urban Load Removed** | 26.1% | 14.7% | 3.8% |

## 10.5 Progress in Meeting MS4 Impervious Restoration, TMDLs, and Maryland Tributary Strategies

This section discusses the progress made to date in meeting the impervious cover addressed by water quality and restoration efforts in the current MS4 Permit (Section 10.4.1), the TMDLs urban non-point nutrient reduction targets (10.4.2), and the current Maryland Tributary Strategies (10.4.3).

### *10.5.1 MS4 Impervious Restoration*

The current MS4 Permit requires that Baltimore County address 20% of the County controlled impervious cover by June 15, 2010. The next term of the permit is anticipated to require an additional 10% impervious cover be addressed over the 5-year term of the permit. Table 10-9 summarizes the Baltimore County efforts to date. The data is

compiled from Tables 10-7 and 10-8 above, excluding the impervious cover controlled by state-of-the-art stormwater management facilities installed through the development process.

**Table 10-9: Impervious Cover Addressed by Water Quality Improvement Efforts to Date**

| Watershed | Impervious Cover to Be Addressed | 20% Target | Impervious Cover Addressed | % Addressed |
|---|---|---|---|---|
| **Upper Western Shore** | | | | |
| Deer Creek | 202.7 | 40.5 | 0 | 0.0 |
| Prettyboy | 534.5 | 106.9 | 0 | 0.0 |
| Loch Raven | 6,169.6 | 1,233.9 | 581.7 | 9.4 |
| Lower Gunpowder Falls | 2,059.1 | 411.8 | 485.5 | 23.6 |
| Little Gunpowder Falls | 608.4 | 121.7 | 11.2 | 1.8 |
| Bird River | 2,080.1 | 416.0 | 604.1 | 29.0 |
| Gunpowder River | 397.2 | 79.4 | 32.1 | 8.1 |
| Middle River | 1,145.8 | 229.2 | 700.1 | 61.1 |
| **Upper Western Shore** | **13,197.4** | **2,639.5** | **2414.7** | **18.3** |
| **Patapsco/Back River** | | | | |
| Liberty | 572.4 | 114.5 | 4.8 | 0.8 |
| Patapsco River | 3,551.8 | 710.4 | 320.2 | 9.0 |
| Gwynns Falls | 4,918.6 | 983.7 | 318.3 | 6.5 |
| Jones Falls | 3,154.3 | 630.9 | 392.5 | 12.4 |
| Back River | 4,931.3 | 986.3 | 1,663.9 | 33.7 |
| Baltimore Harbor | 2,818.2 | 563.6 | 734.8 | 26.1 |
| **Patapsco/Back River** | **19,946.6** | **3,989.3** | **3,434.5** | **17.2** |
| ***County Impervious*** | ***33,171.1*** | ***6,634.2*** | ***5,849.2*** | ***17.6*** |

With the inclusion of street sweeping and storm drain cleaning, the county is currently addressing 17.6% of the impervious cover controlled by Baltimore County. That estimate is a liberal estimate, in that it does not account for the overlap in the various water quality improvement efforts. Future reports will attempt to correct this deficiency. It is anticipated that the ability to address additional impervious cover will become more difficult over time as the easier projects are completed. We will rely on our Small Watershed Action Plans to identify actions needed to meet the various TMDLs that are developed for each watershed for a variety of constituents. Implementation of those plans and meeting the TMDL reduction requirements will be considered as meeting the impervious cover requirement in each planning area. It is not anticipated that a water quality device will treat every impervious acre.

### *10.5.2 TMDL Progress*

Baltimore County has not yet developed a mechanism for estimating bacteria loads, nor efficiencies of the various urban best management practices in reducing bacteria loads. Table 10-10 presents the progress in meeting TMDLs for nutrients. This progress includes the nutrient reductions achieved by stormwater management facilities installed through the development process.

**Table 10-10: Progress in Meeting Nutrient TMDLs Where Developed**

| Watershed | Phosphorus | | Nitrogen | |
|---|---|---|---|---|
| | Target | Progress | Target | Progress |
| Prettyboy | 15% (54%) | 1.2% | NA | NA |
| Loch Raven | 15% (50%) | 6.6% | NA | NA |
| Patapsco | 15% | 7.3% | 15% | 4.4% |
| Gwynns Falls | 15% | 10.3% | 15% | 6.3% |
| Jones Falls | 15% | 7.3% | 15% | 6.1% |
| Back River | 15% | 20.3% | 15% | 7.0% |
| Baltimore Harbor | 15% | 14.7% | 15% | 3.8% |

As can be seen from Table 10-10 the target reductions for phosphorus and nitrogen have not been met, with the exception of the phosphorus reduction for Back River. In the cases of Prettyboy and Loch Raven Reservoir watersheds, the target phosphorus reduction is much higher (shown in parentheses), however, the reduction scenario developed by Maryland Department of the Environment indicates a 15% reduction of phosphorus from urban lands.

### *10.5.3 Maryland Tributary Strategies*

Based on modeling by the federal EPA – Chesapeake Bay Program, nutrient and sediment pollutant load reductions needed for the Chesapeake Bay to attain water quality standards have been determined. These load reductions have been allocated to the various states within the Chesapeake Bay drainage area. Maryland has developed Tributary Strategies for the 10 basins within the state. Baltimore County lies within two of the tributary basins, the Upper Western Shore and the Patapsco/Back River basins. The Tributary Strategies identify the actions needed to achieve tidal Chesapeake Bay water quality standards. Actions to address urban non-point source reductions are expected to achieve a 24% reduction in nitrogen and a 42% reduction in phosphorus from urban lands. These goals may be revised, and made more specific to tidal water segments when the Phase 5.3 watershed model is complete in December 2010.

At this point in time, Baltimore County is not tracking all of the strategies for which pollution reduction credit can be awarded. We are uncertain on how to obtain credit for the educational activities that fall under the designation of urban and mixed nutrient management. Our tracking for reforestation needs to be improved to differentiate between urban pervious and mixed-open planting. For now, the acreage is combined.

The strategies developed apply to all of the jurisdictions within a Tributary Strategy basin, and have not been partitioned by jurisdiction. Table 10-11 presents the urban strategy for the Upper Western Shore, while Table 10-12 presents the urban strategy for the Patapsco/Back River. The strategy column in both tables represents the target for all jurisdictions within the Tributary Strategy basin, while the progress column only represents Baltimore County progress in meeting the urban strategy.

*Stormwater Management:* The stormwater management strategy represents the acreage of land that flows to a stormwater management facility (see Section 1), and includes only those facilities that have been built. It also includes the construction of new stormwater management facilities through the capital program (see Section 7), but not the conversion of existing facilities.

*Erosion and Sediment Control:* The acreage of disturbance for calendar year 2009 only is included (see Section 2). This represents the acreage under sediment control. Missing the target for this measure does not represent a failure, but reflects the pattern of development through time. Under the current economic conditions development is down. A better measure for this BMP would be that 100% of the acreage under development is under sediment control.

*Stream Restoration:* The stream restoration strategy represents the target linear feet of urban stream restoration. The information for this measure comes from the individual watershed restoration tables in Section 7.

**10-11: Upper Western Shore Urban Tributary Strategy**

| Urban BMP Type | Units | Strategy | Progress |
|---|---|---|---|
| Stormwater Management | Acres | 56,784 | 13,286 |
| Erosion and Sediment Control | Acres/Yr | 5,576 | 200.6 |
| Nutrient Management, Urban | Acres | 67,206 | NT |
| Nutrient Management, Mixed | Acres | 86,984 | NT |
| Buffers Forested, Urban | Acres | 93 | 69.9 |
| Tree Planting, Mixed Open | Acres | 433 | 17.7 |
| Tree Planting, Urban Pervious | Acres | 597 | |
| Stream Restoration, Urban | Linear feet | 87,368 | 82,847 |

NT = Not Tracked

**10-12: Patapsco/Back River Urban Tributary Strategy**

| Urban BMP Type | Units | Strategy | Progress |
|---|---|---|---|
| Stormwater Management | Acres | 99,252 | 18,705 |
| Erosion and Sediment Control | Acres/Yr | 11,063 | 229.2 |
| Nutrient Management, Urban | Acres | 112,861 | NT |
| Nutrient Management, Mixed | Acres | 28,171 | NT |
| Buffers Forested, Urban | Acres | 160 | 24.0 |
| Tree Planting, Mixed Open | Acres | 691 | 43.0 |
| Tree Planting, Urban Pervious | Acres | 205 | |
| Stream Restoration, Urban | Linear feet | 82,421 | 37,716 |

NT = Not Tracked

In order to assess the progress in meeting the Maryland Tributary Strategy nutrient load reduction, the individual watershed load reductions from Tables 10-7 and 10-8 were summed, along with the individual watershed urban non-point nutrient loads. The overall percentage reduction for nitrogen and phosphorus due to urban BMPs for each tributary basin was calculated. The results are presented in Table 10-13.

**10-13: Tributary Strategy Urban Non-point Nutrient Load Reduction Progress**

| | Upper Western Shore | | Patapsco/Back River | |
|---|---|---|---|---|
| | Nitrogen | Phosphorus | Nitrogen | Phosphorus |
| Urban Load (#s) | **497,601** | **47,372** | **775,604** | **80,281** |
| Urban BMP Load Reduction (#s) | 43,940 | 6,310 | 43,403 | 9,433 |
| Urban BMP Load Reduction (%) | 8.8 % | 13.3 % | 5.6% | 11.8% |
| Trib Strategy – Target Reduction (%) | 24 % | 42 % | 24 % | 42 % |

## *10.6* Summary

Nutrient pollutant load reduction from urban sources is progressing through the use of a variety of urban best management practices. As of this time, we have not achieved the

target percentage reductions for either the TMDLs developed to date, nor the Tributary Strategies. We are close to meeting the NPDES Permit requirement in addressing impervious cover through water quality improvements. Baltimore County will work towards establishing a mechanism to account for urban nutrient management progress through our education programs.